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Food safety standards and agri-food supply chains: an introductory overview

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1. Introduction

In recent years there has been an increased focus on food safety in Europe and elsewhere. Public food safety standards have been enforced through legislation, and firms at different levels of the supply chain have developed various private standards. Within the public arena this has led to profound changes in regulations at national, regional and multilateral levels. Legislations adopted to improve food safety include standards regarding the characteristics of the final product (e.g. maximum residue levels), production practices in the food supply chain, traceability within the supply chain and the legal liability of the supply chain. At the international level, formal and informal discussions have primarily focused on the legitimacy and harmonisation of standards (Henry de Frahan and Vancauteren, 2006). The change in public regulations has been accompanied by an increased use of private standards. These standards, which may include rules on infrastructure, equipment, modes of production, processing and quality management, often stipulate more stringent requirements than required by law.

Public and private standards do not only influence how safe the final goods are, but also affect the internal organisation of firms, their strategic behaviour and the organisation of the supply chain. Hence, they affect the market power of actors, the distribution of profits along the supply chain and the welfare of all stakeholders. The literature on Minimum Quality Standards (MQS) shows that imposing a minimum product standard through regulations affects the prices, the quantities and varieties supplied, and the welfare of stakeholders (Scarpa, 1998; Garella, 2006). Hence, standards affect competition, and the success of public policies depends on the firm's strategic response. Standards are also highly relevant in the trade context and there is an extensive literature concerning to what extent they may work as trade barriers (Korinek *et al*., 2008). Policy-makers must consider all these aspects when formulating public policies if they are to succeed in assuring that food sold to consumers fulfils the desired requirements with respect to food safety and that this is achieved with the least possible market distortion due to public intervention.

Apart from the literature on MQS, theoretical developments and quantitative empirical analysis have in the existing economics literature on food safety received limited attention to date. The aim of this special issue is to help fill this gap, focusing on theoretical models of industrial organisation and international trade as well as quantitative empirical analysis to further enhance the understanding of how markets function and different stakeholders interact.

2. Standards, firm strategies and organisation of the supply chain

In this section we discuss some of the issues that we perceive to be central for understanding how standards affect the market and the organisation of the supply chain. Based on previous literature we briefly discuss the role of public regulations, how standards affect competition and the coordination within the supply chain.

2.1 Compliance with public regulations

Compliance with public regulations is a minimum requirement for firms to gain market access.[1] How a MQS affects the functioning of markets and the interaction between different stakeholders has been extensively analysed in the literature on industrial organisation and international trade. It has, however, become more common that public regulations stipulate requirements concerning the quality of the final product (sold to consumers) but, to some extent, leave it up to individual firms to choose the appropriate way of achieving this. Partly in order to comply with public standards, farmers and agro-food firms have had to change their production processes and to improve coordination between different parts of the supply chain. This has, to a large extent, been achieved by adopting and requiring suppliers to adopt various private standards that are more demanding than the legal requirements. Some of these standards are firm-specific while others are collectively adopted by a group of stakeholders in the supply chain (producers, process firms and retailers).[2]

If firms do not adhere to regulations they may, based on public monitoring and inspection, incur economic losses because of fines, deadweight losses generated by the withdrawal or recall of certain products, temporary or permanent cessation of business etc. Such potential costs give firms an incentive to adopt private standards in order to ensure compliance. Firms may also adopt various standards in order to avoid legal liability and negative demand effects in case a food safety crisis occurs. These arguments cannot, however, fully explain the incentives for companies to develop and adopt voluntary standards that go beyond legal requirements and that sometimes are quite costly to implement. The expected benefits of adopting a private standard can be larger if evaluated

1 When public standards are mandatory, public standards may, however, also be voluntary.
2 For a discussion of different kinds of standards, see Henson and Humphrey (2009).

in a dynamic setting, taking into account the changes in the upstream industrial structure and/or in the supply chain structure (Caswell *et al*., 1998).

2.2 Competitive advantages

A number of studies suggest that expected competitive advantages are important reasons for firms to embrace private standards. Private standards may confer competitive advantage due to improved control and increased efficiency, i.e. direct positive externalities generated by the (quality) management systems adopted (Henson and Caswell, 1999). Due to the heterogeneity of firms, standards may also increase the competitive advantage of the firms that can most easily adhere to a specific standard (due to differences in resources, cost structures etc.). This may explain why a specific firm or group of firms prefers one type of standard rather than another. Firms may, for example, benefit from preempting public regulations by adopting a private standard (Segerson 1999; Lutz *et al*., 2000) and/or, in the choice of a private standard, from choosing the standard that best suits the objective and conditions of the firm. As firms differ in how easily they can comply with different public standards, firms may, in extreme cases, have incentives to lobby for more stringent regulations. Lobbying for a high standard may result in a better competitive position and may even exclude competitors from the market either by preventing firms from entering the market or driving existing firms out of the market.

If barriers to entry are prejudicial to a properly functioning market in a closed economy, the adverse effects may be even larger in an open economy (Lutz, 2000). Sanitary and phytosanitary (SPS) regulations as potential non-tariff barriers to entry have been extensively studied in the literature (Beghin and Bureau, 2001). The legitimacy of SPS standards is questioned, notably by developing countries, on the basis that the regulations are more stringent than what is required by *Codex Alimentarius* and, hence, they constitute barriers to trade. In the international framework, the spread of private standards and the heterogeneity of public regulations have made it increasingly difficult for producers in developing countries to assure market access (Otsuki *et al*., 2001; Fulponi, 2006; Henson and Humphrey, 2009).

The potential competitive advantages of adopting private standards are not limited to supply-side effects. Private standards may also generate a competitive advantage if they have a positive effect on demand. Due to the credence aspect of the attribute 'safe food', standards may be used to provide information to consumers. They can help consumers to evaluate the quality of food products by increasing the transparency of the production processes and the traceability of products (Dickinson and Bailey, 2002). A potential premium paid by consumers for the attribute 'safe food' may be an important incentive to develop and/or adopt private standards provided that these efforts are explicitly or implicitly communicated to consumers (Roosen, 2003).[3] In a

3 While many quality characteristics can easily be used by retailers to differentiate their products in the final market, this is not necessarily the case with safety characteristics. Experimental

context of imperfect information, quality is a way of differentiating products and improving competitiveness (Caswell *et al*., 1998) and certification can signal this to consumers (Roosen, 2003). Signalling is particularly important when consumers react to the perceived rather than the objective risk that the supply chain fails to provide safe food in the final market (Grunert, 2005). It is therefore essential to assess consumers' perceptions of risk to determine their willingness to pay and to evaluate the challenges of specific standards (Grunert, 2005; Giraud-Héraud *et al*., 2009).

2.3 Coordination within the food supply chain

As food safety in the final market depends on several stages of the supply chain, some kind of vertical coordination is necessary in order to assure compliance with regulations and to avoid potentially negative demand effects. Coordination is often achieved by written contracts regulating the relationship between upstream and downstream firms. Contracting between different levels of the supply chain in order to provide safe food may be problematic as firms have only limited information about the efforts made by their suppliers (Hennessy, 1996). Optimal contracting with asymmetric information has been analysed in the theoretical principal-agent literature (Chalfant *et al*., 2002; Starbird, 2005). Some studies (e.g. Starbird and Amanor-Boadu, 2007) have shown how the incentives of suppliers to invest in food safety may depend on various characteristics of the inspection system (frequency and accuracy of inspection) and the different costs associated with failing to provide safe products (magnitude of the costs and their allocation within the supply chain).[4]

Although the empirical literature is relatively limited, there is some evidence that tighter coordination may change the relative bargaining power within the industry resulting in additional tensions in the relation between actors. This change in bargaining power is one of the reasons for producers potentially being excluded from the food marketing chain (Fulponi, 2006; Giraud-Héraud *et al*., 2008). Public and private standards may marginalise small producers as large producers and subsidiaries of multinationals operating in developing countries are better equipped to adapt to more stringent requirements (Dolan and Humphrey, 2000). Hence, exclusion may be a particularly severe problem for firms in developing countries (van der Meer, 2006).

studies have shown that consumers perceive 'safe' food as a basic characteristic that they expect from all products and, hence, may not be willing to pay a premium for (Rozan *et al*., 2004). Although food safety attributes are rarely directly communicated to consumers, firms do include safety characteristics in their standards and do communicate other attributes related to the production process (e.g. ecological, traceability, geographic origin) that consumers may associate with food safety (Henson and Humphrey, 2009).

4 See Elbasha and Riggs (2003) for a discussion on providing producers and consumers with precautionary incentives when costs are shared.

In addition to adopting internal policies and strategies for vertical coordination, companies at different stages of the supply chain use horizontal coordination to develop and adopt common voluntary standards (e.g. GLOBALGAP, BRC Global Standard for Food Safety, IFS).[5] Such standards often involve a combination of both vertical and horizontal coordination. These collective standards have become more and more common in recent years, and they show that the industry collectively takes responsibility for food safety in the supply chain, often using business-to-business approaches where the efforts are not communicated to consumers.[6] The emergence of these collective standards and their dissemination may be motivated both by collective rationality, as negative demand effects of most food safety crises are not restricted to just the products supplied by the 'failing' firm, and by individual rationality, as discussed in the previous section (Giraud-Héraud *et al*., 2008). In an international context, the extent to which collective private standards can be perceived as trade barriers is an ongoing discussion. As opposed to public standards, collective private standards are not regulated through the WTO although they may have similar effects on trade if widely required by firms in certain countries/regions (Henson and Humphrey, 2009).

3. Contributions to the special issue

The contributions to the special issue uses various approaches to cover a range of different issues related to the previous discussion. Two of the articles have a more theoretical perspective and three are more empirically oriented. The first two articles analyse public regulations in a trade setting but from very different perspectives.

In the first article, Rau and van Tongeren examine the market and trade effects of food standards taking the costs of compliance and firm heterogeneity into account. They develop a partial equilibrium model within an oligopolistic market framework. The model is applied to the case of meat trade between Poland and EU15. Simulations are conducted in order to analyse how subsidies given to Polish firms to facilitate their compliance with EU food standards have affected trade and market structure. The paper contributes to the literature by explicitly endogenising the decision on whether or not to export in a framework of heterogeneous firms. It is shown that the compliance costs associated with adhering to the EU food standards tend to favour more productive and larger firms and thus increase concentration with respect to production and exports. The lower the substitution on the demand side, the

5 GAP in GLOBALGAP is an abbreviation for Good Agricultural Practice, BRC is an abbreviation for British Retail Consortium, and IFS for International Food Standard.

6 In response to prior food safety crises such as the BSE, supply chains have adopted several strategies. Two of the main types are: (i) business-to-business approaches, such as GLOBALGAP, focusing on collective actions as the entire industry may be affected by the decline in consumption in the case of a food crisis and (ii) business-to-consumer approaches used by some companies to differentiate their products from the products of competitors by communicating efforts to assure food safety.

stronger is this effect. A general conclusion is that subsidies given to exporting firms to comply with importing countries' MQS slow down structural change as they lower the productivity required for exporting.

The second article, by Swinnen and Vandemoortele, adopts a political economy perspective. The objective is to develop a theoretical model and analyse how different types of standards affect the political economy of standards. Specifically, they examine how the nature of standards affects the politically optimal level of the public standard and the likelihood of trade conflicts. This is done within a framework of a small open economy without any private standards. Food safety standards are analysed and compared with food quality standards (FQS) and standards concerning social and environmental aspects (SES). The paper contributes to the literature by explicitly incorporating risk into a political economy setting analysing different types of standards. The politically optimal level of a standard is shown to depend on the relative strength of lobbying groups and on how consumers and producers are affected by the standard. It is shown that FSS will be set at a higher level than FQS, and that SES may be set higher or lower than FSS, depending on the effect on consumer utility and the warm glow effect. The perceived probability of deficiency is shown to have a potentially important impact. A central result is that the most stringent standards do not necessarily have the largest effects on trade. It is emphasised that the impacts different standards have on trade are complex and that the difference between the politically and the socially optimal standard depends on the relative lobbying contributions of different groups, biases in perceived risk and the magnitude of the warm glow effect.

That firms have an incentive to influence the type of standard is a crucial aspect in the paper by Swinnen and Vandemoortele, as well as in the third article by McCluskey and Winfree. Instead of considering firms lobbying to influence the design of a future public standard, McCluskey and Winfree focus on the interaction between private and public standards. Specifically, they analyse the strategic incentives for firms to adopt a certain type of private standard in order to pre-empt and thereby influence the public standard. Although the incentives for firms to pre-empt regulations by adopting private standards have been analysed in the literature within a game-theoretic framework, the novelty of this paper is that it gives an alternative explanation for firms to pre-empt regulation by choosing one of several possible private standards rather than just the level of a specific standard. It is shown that it may be beneficial for firms to choose the type of standard that minimises their cost before any public regulation has been adopted.

The fourth paper focuses on coordination within the supply chain. Vertical coordination is necessary to enable traceability and assure that the final products meet the desired standard. Specifically, Fischer *et al*. examine which factors influence the type of contracts firms choose and the sustainability of the relationships in agro-food supply chains. The supply chains examined in the empirical analysis included European pig meat, beef and cereals. They assume that firms can choose either implicit contracts, represented by spot

markets and relational contracts, or explicit contracts, represented by written contracts and cross-shareholding arrangements. On the basis of theoretical and empirical findings, they state a number of hypotheses concerning the relationships in the supply chain. The hypotheses are tested in a logit regression model and in a structural equation model (SEM), using data obtained from a survey made in six EU countries. The results show that the choice of contract type is affected by market-, industry- and enterprise-specific factors. The sustainability of relationships within the agro-food supply chain is found to depend on chain-internal, dyadic factors.

In the last paper, Mazzochi analyses how the value of listed firms are affected by new food safety regulations. The event study approach is extended to account for uncertainty concerning the date of a new regulation by including a time-varying intercept capturing excess returns. Applied to events related to EC Regulation 1881/2006 (i.e. the announcement, introduction and national enforcement thereof), the analysis is conducted using both the standard event study approach and the extended approach accounting for uncertain timing in an alternative way. This paper contributes to the literature by applying the event study approach to food safety regulations and by the methodological extension applied. The results show that the proposed extension to some degree manages to detect abnormal returns.

4. Outlook

As a result of the increased focus on food safety, a multitude of public and private standards have been adopted around the world. While a lot of research on different aspects of food safety has been conducted, it has, to a large extent, been fairly specialised. We argue that analysing the effects of standards, whether public or private, requires the perspectives of both (i) public economics and social choice (provision of a socially desirable level of food), and (ii) industrial economics (cost efficiency and competition). A more extensive combination of these two approaches would be beneficial for future research on food safety standards as it relates to important issues such as the legitimacy of standards in a closed economy as well as in an international setting, the increased use of collective private standards and the interaction between public and private standards.

Industrial economics research commonly focuses on an overall quality without explicitly separating the attributes of food safety and other attributes (taste, quality, appearance etc.). It would be fruitful for future research to incorporate the risk dimension of food safety more explicitly into the analysis of the effects of standards by separating food safety attributes from other quality attributes. The multidimensionality of standards relating to this issue is discussed in two of the papers in this special issue, but more of both empirical and theoretical research is needed in this area.

The risk of market failure legitimates public standards as a way of assuring safe food in the final market. In designing policies, governments must, however, also consider how the market is affected by public intervention.

Hence, the benefits of improving food safety must be weighed against the potential costs associated with market distortions resulting from public interventions. In order to evaluate the effectiveness of public intervention, both of the previously mentioned approaches should be adopted. This is especially important as the most important aspect of ensuring food safety may not be what the minimum product requirements should be but rather what tools should be used to achieve it (assurance schemes, infrastructure, training etc.).

The increased use of private standards, and especially collective private standards, has fuelled an ongoing debate on the substitutability/complementarity of private and public standard. This is an important and complex issue that needs to be analysed with respect to both the functioning of markets and the safety in the final market. This issue is especially pertinent in the international trade context, as the effects of market distortions resulting from standards may be most severe for producers in developing countries who lack the capacity to comply.

There has, in recent years, been an increased use of collective private standards that involve both vertical and horizontal coordination. Although collective private standards are commonly observed, relatively few studies have formally analysed the extent to which they provide food safety and affect markets and international trade, taking both the horizontal and vertical coordination into account. Hence, this is an area that requires additional research in the framework discussed above. Furthermore, the strategic interactions between firms at different stages of the supply chain, changing bargaining powers and the effect of the restructuring of the supply chain, are issues that need to be further analysed in both the theoretical and empirical literature related to food safety within this framework.

Although food safety involves many issues that require further research, the points raised in this concluding remark are in our opinion particularly important as they can contribute to a better understanding of how markets function with respect to food safety and thereby how to assure safe food in the final market.

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